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Predictive resource planning: coupling construction needs with demolition waste forecasts

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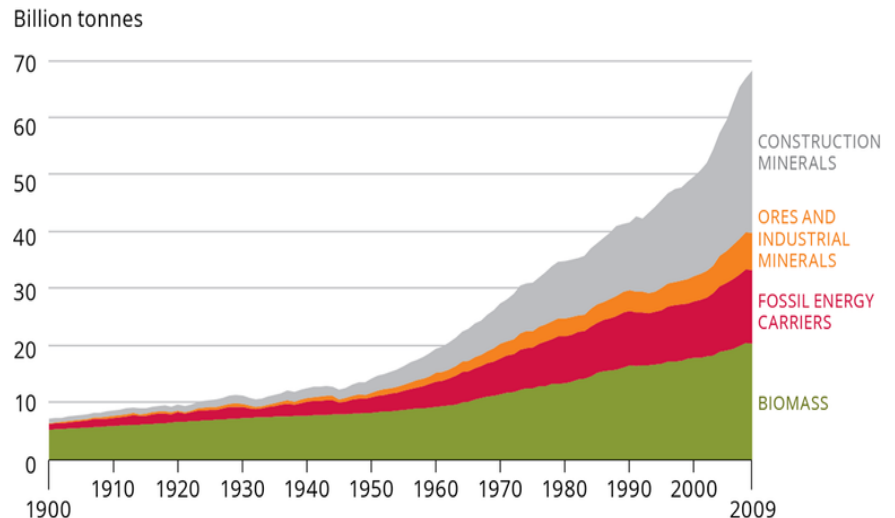
› PREDICTIVE RESOURCE PLANNING: COUPLING CONSTRUCTION NEEDS WITH DEMOLITION WASTE FORECASTS

Elisabeth Keijzer, Jacco Verstraeten-Jochensen, Sanne van Leeuwen, Mara Hauck, Elmer Rietveld

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RESOURCE EFFICIENCY IN THE CONSTRUCTION SECTOR

- › EU Waste Framework Directive: recycle/recover 70% of non-hazardous construction and demolition waste (CDW) by 2020
- › Current recycling systems function insufficiently (Dahlbo et al., 2015)
- › New processes & techniques *could* lead to:
 - › Higher resource efficiency
 - › Reduced environmental impact
 - › Less societal impact



Global resource consumption (Krausmann et al., 2009)

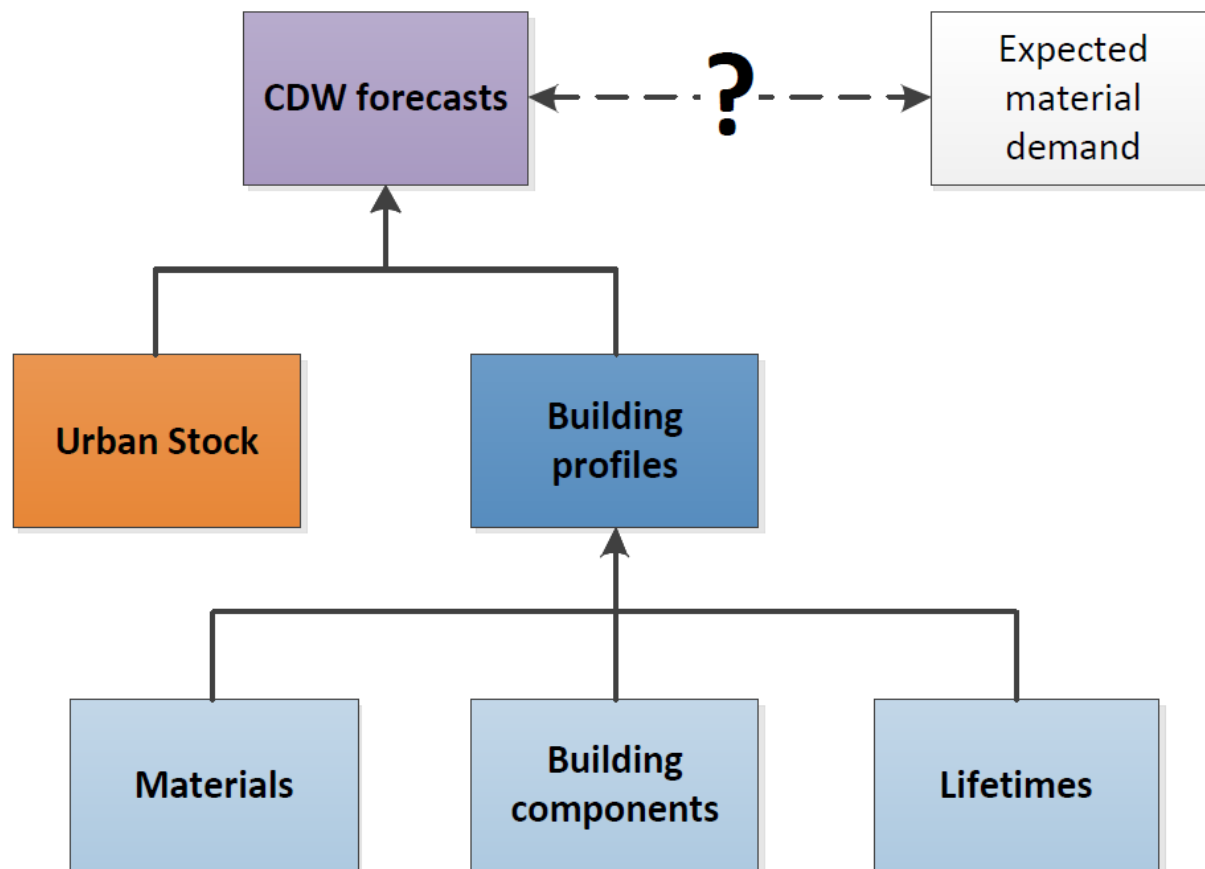
METHODS TO QUANTIFY

- › To direct efforts and investments, we need to be able to forecast material availability and quality
- › Various methods exist for CDW quantification, e.g. (Wu et al. 2014):
 - › Site visits;
 - › Generation rate calculation;
 - › Lifetime analysis;
 - › Classification system accumulation;
 - › Variables modelling.
- › However, application of CDW forecasting methods is not common practice in resource management
- › Lifetime Analysis (LA) could improve forecasting and thereby create added value in terms of environment, employment and resource management

RESEARCH QUESTION

*Can we develop a reliable CDW forecasting model
to be used in decision making
on resource efficiency
in the construction sector?*

MODEL DESIGN



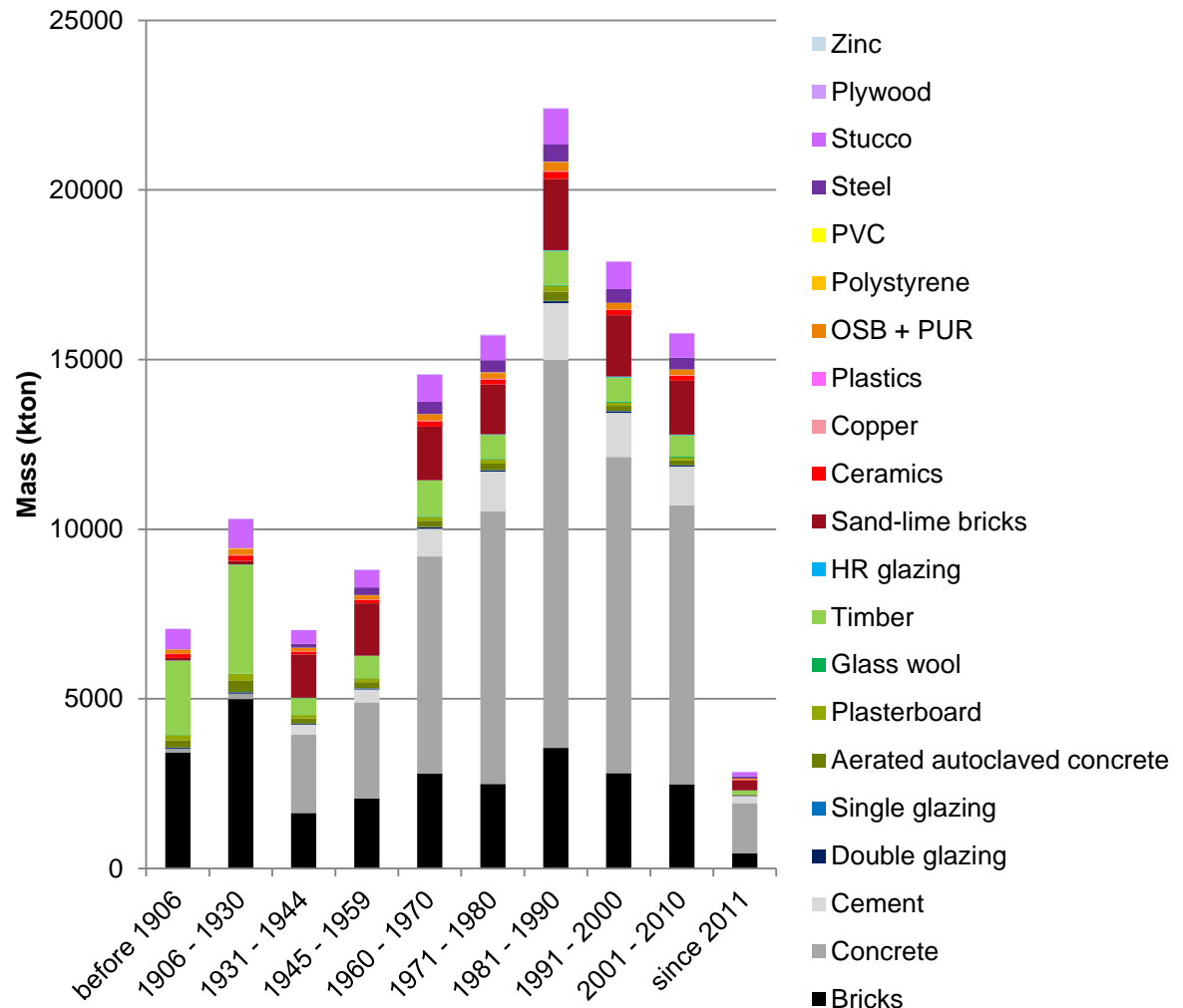
THE CASE: TERRACE HOUSES (IN AMSTERDAM)

- › The Netherlands: replacement rate of dwellings is low (0.4% = dwelling lifetime of 200 years - Mulder et al. 2015)
- › Amsterdam Metropolitan Area as a case study: strategically important & architecturally diverse
- › Typical Dutch dwelling: terrace house
 - › 8 architectural styles/construction periods
 - › 15 building components
 - › 23 materials
 - › 10 year period (2015-2024)



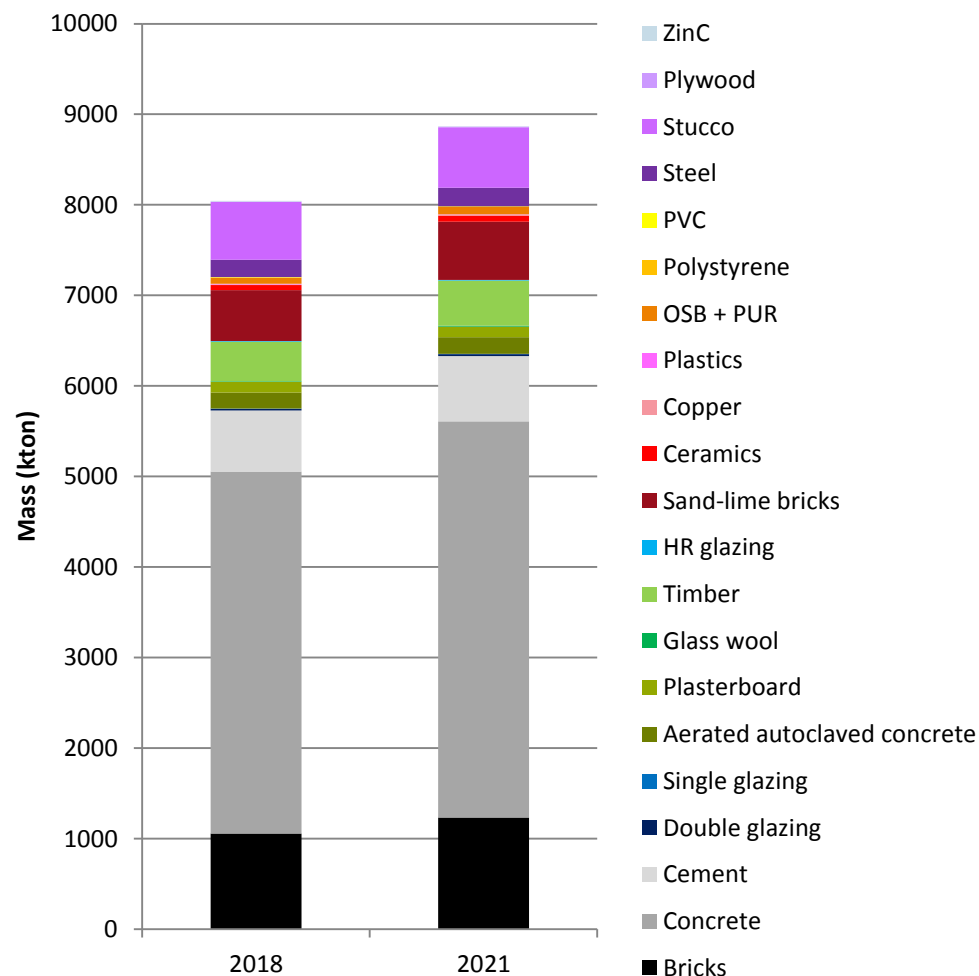
RESULTS (1): URBAN STOCK

- › Urban stock of Amsterdam Area \approx 120,000 kton of resources
- › Largest volumes:
 - › Concrete (41%)
 - › Brick (22%)
 - › Sand-lime bricks (10%)
 - › Timber (9%)
 - › Cement (6%)



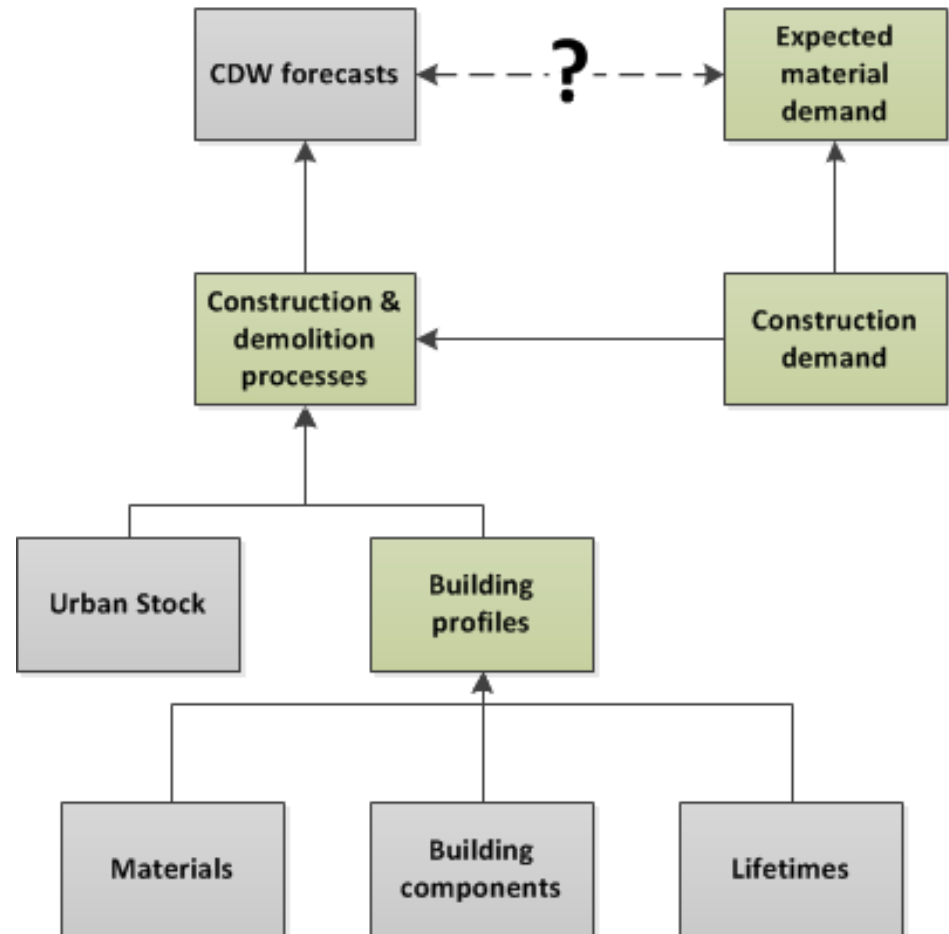
RESULTS (2): CDW FORECASTS

- › CDW is estimated at 8000 to 9000 kton/year, based on average lifetime of building components
- › This corresponds to roughly 7% of all materials stored in the urban stock
- › Real values are influenced by more factors: e.g. less CDW due to economic circumstances



DISCUSSION OF RESULTS

- › Proof of principle: model can create a starting point for transforming waste to resources
- › The variation in LA forecasts is too little to be useful in year-to-year decision making
- › Model is only a prototype; improvements to be made
- › Validation, testing & reviews



RECOMMENDATIONS FOR FURTHER RESEARCH

- › Complement the Lifetime Analysis methodology to incorporate economic circumstances
- › Deepen, broaden and improve models
 - › Connection to LCA & economic models
 - › Improvements in data availability and accuracy
 - › Case studies
- › Development of a new generation of decision support tools
- › New stimulus for product design

An aerial photograph of a city construction site. Several large tower cranes, some green and some blue, are visible against a clear blue sky. The ground is filled with construction materials, scaffolding, and partially completed buildings. In the background, a dense urban landscape with various city buildings is visible.

› THANK YOU FOR YOUR ATTENTION

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